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NYASALAND PROTECTORATE

Report for the Department of Agriculture For the year 1946

PART II—EXPERIMENTAL WORK

As in previous years shortage of staff resulted in a severe reduction of experimental work on general agriculture. It was fortunately possible to continue work already begun on tea and tung but some new experiments which had been contemplated and should have been commenced this year had to be abandoned through shortage of African labour.

TUNG

TUNG EXPERIMENTAL STATION, CHOLO

Senior Agricultural Officer in charge : C. C. Webster

1. In common with most of the departmental stations, and with estates, the Tung Experimental Station suffered from shortage of labour, especially during the early part of the rainy season. It was often impossible to carry out the necessary cultivations at the proper time and as a result field experiments, especially manurial trials, had their efficiency markedly impaired. In these circumstances it was naturally impossible to plant any new experimental areas, although this had been intended.

2. The work of the station continued to fall under two main heads : the production of improved planting material of the species *Aleurites montana*, and the improvement of yield by manuring and cultural methods. The former has been the major part of the work and is attempted mainly by the selection of outstanding mother trees and their propagation as buddings.

Selection of Promising Mother Trees

3. The survey of existing seedling plantations in bearing on estates, which was begun in 1940 with the small number of trees then in bearing, was again extended. Further areas totalling 12,000 trees were examined bringing the total number of trees in the plantations surveyed to 52,000 from which 746 promising trees have been selected for yield recording. After several years of yield recording the best of these provisional selections are propagated as buddings and planted in clone trials at the experimental station but owing to labour shortage it was not possible to open new land during the year and the number of clones under trial has remained 68. The progress of this selection work has not been all that could be desired as apart from difficulties mentioned in previous reports, such as the year to year yield variation and the tendency to select for precocity, there have also been simple practical difficulties. For example, the selected trees are scattered throughout plantations on 19 estates and it not infrequently happens that the recorders arrive to find that a part or the whole of the crop of a tree has already been removed by the estate personnel.

4. The yields of all trees in the seedling plantation at the Zomba Experimental Station were again recorded. In 1945 the original trees, which are the oldest in the Protectorate and were 13 years old, gave a record crop equivalent to 1,260 lbs. of dry seed per acre. This year they gave only 840 lbs. per acre ; but it is not thought that the drop indicates that the trees have passed their natural peak of production as the 1945 crop followed a small yield in 1944 due to hail damage and it is thought that soil deterioration and lack of cultivation is also reducing the productivity of the plantation.

Vegetative Propagation as Buddings on Seedling Rootstocks

5. Buddings on seedling rootstocks are under trial in a number of experiments both at the experimental station and on estates and several of these are now old enough to give results of interest, although they contain only clones derived from the earliest selections and it is hoped that those from some of the later mother trees will give higher yields.

Buddings versus Seedlings

6. When the work of improvement was begun in 1940 it was obviously desirable as a first step to compare buddings with seedlings, and two of the earliest trials make this comparison. The first is a small randomised block trial dating from September, 1940, which gave the yields shown in Table 1 in 1946 when the trees were 5½ years old.

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TABLE 1

Lbs. of Air Dried Hulled Seed

	Per tree	Per acre*	Sig. diff. per tree, P=0.01
Buddings	13.8 ...	1,103 ...	—
Seedlings	6.6 ...	530 ...	5.2

*Trees planted at 25 ft. hexagonal, = 80 per acre.

Buddings have given significantly higher yields than seedlings (P=0.01). The same result was obtained in 1943 : in 1944 the crop was destroyed by hail.

7. The second trial, which was planted at the experimental station in December, 1940, compares unselected seedlings derived from ordinary bulk seed, " selected seedlings " raised from open pollinated seed taken from four selected trees, and buddings from the same four trees on both *fordii* and *montana* stocks. The yields for 1945 and 1946 are shown in Table 2, from which it will be seen that in both seasons buddings on *montana* stock have significantly outyielded all other treatments and that buddings on *fordii* stock were better than unselected seedlings but not superior to selected seedlings. The yields from this trial are rather low as the soil on which it is sited is on the poor side. Differences in vigour have been apparent for the past 3 years, the seedling trees being distinctly bigger than the buddings and the *fordii* stock exerting a dwarfing effect as compared with the *montana*. These differences are reflected in the girth measurements for 1946 shown in Table 2.

TABLE 2

Lbs. Air Dried Hulled Seed

Age Years		Buddings		Seedlings		Sig. diff. per tree	
		Montana Stock	Fordii Stock	Selected	Un-selected	P= 0.05	P= 0.01
4	Per tree	6.7	3.7	3.1	2.3	1.41	1.95
	Per acre*	376	207	171	132	—	—
5	Per tree	9.3	6.2	4.6	4.4	1.78	2.46
	Per acre*	521	349	257	246	—	—
5½	Girth, inches	18.2	15.3	21.6	20.9	1.27	1.76

*Trees planted 28 ft. square = 56 per acre.

Clone Trials

8. The yields of the four clones on the *montana* stock in the experiment just described are shown for 1945 and 1946 in Table 3.

TABLE 3

Lbs. Air Dried Hulled Seed

Age, Years		Clones				Sig. diff. per tree	
		ZM8	ZM13	ZH14	ZF9	P=0.05	P=0.01
4	Per tree	6.1	9.3	6.1	5.4	1.86	2.44
	Per acre*	342	521	342	302		
5	Per tree	9.8	11.2	9.8	6.6	1.61	2.11
	Per acre*	549	627	549	370		

*Trees planted at 28 ft. square = 56 trees per acre.

TABLE 4

Lbs. Air Dried Hulled Seed

Age, Year		Clones					Sig. diff. per tree	
		ZM8	ZM13	ZN24	ZN10	ZF9	P=0.05	P=0.01
5	Per tree	14.6	20.2	10.0	9.4	14.7	7.5	9.9
	Per acre*	1,168	1,616	800	752	1,175		

*Trees planted at 25 ft. hexagonal = 80 per acre.

The clone ZM13 has given the highest yield, but whereas in 1945 it was significantly better than all others, in 1946 it is only significantly better than ZF9. Table 4 shows the 1946 yileds from the buddings versus seedlings trial described in para. 6 above and it will be seen that here also ZM13 is significantly better than all others, as it was in 1943. Further yield records from clones of buddings are available from the intercropping trial at the station, the average yields of the five clones from this experiment under all cultural treatments, and also on the soya plots only, being in Table 8. Clones 10 and 14 have been significantly better than all others in both seasons and clone 10 was better than 14 in 1946. Both these clones are of the bushy, precocious type, while the other three are of the type which is usually more vigorous and comes into bearing more slowly. Clone 10, however, combines both vigour and precocity, although its habit of growth is dense and bushy. The yields obtained from both 14 and 10 this season are excellent.

Unfortunately the fourteen clones which have been under observation at Kamponje since 1943 suffered from a severe hailstorm this season and as most of the crop was stripped from the trees the yield records are of little value. In the absence of valid yield records from these clones, little can be added to what was said last year on the subject of buddings. Once again buddings have clearly demonstrated their superiority to seedlings and even amongst the earliest clones there are some which are very promising, notably ZM13, 14 and 10.

Variation in flowering and fruiting characters between Clones

9. In 1944 and 1945 some investigation was made of clonal differences in flowering habit and fruit setting and of the possible correlation of these characters with yield. This was done with the five clones in the intercropping trial,—ZM8, ZN24, ZF9, 14 and 10. Of these the first three are type A clones, which grow vigorously, make their first branches relatively high, and thereafter produce whorl after whorl of primary branches one above the other at fairly long intervals on the main trunk. The other trees are type B clones which are less vigorous, branch low and at very short intervals and have less tendency to increase in height, thus making low, dense, bushy trees. The type B clones are more precocious in bearing than the type A and in this trial they have so far consistently given the highest yields. In both seasons 10 flower clusters on each of 26 trees of each clone were examined and a record was made of the number of male and female flowers per cluster, the number of fruit per cluster, the percentage of female flowers setting fruit and the number of seeds produced per female flower.

10. Significant differences between clones in respect of these characters were found in both seasons. As the main interest lies in possible correlations with yield it seems unnecessary to reproduce a full summary of the data here, and only the figures for number of female flowers per cluster and percentage of female flowers setting fruit are given in Table 5.

TABLE 5

		Clones						Sig. diff. between clones	
Character	Year	14	10	ZN24	ZM8	ZF9	Means	P=0.05	P=0.01
No. of female flowers per cluster	1944	12.57	21.30	22.33	13.71	27.27	19.26	1.97	2.59
	1945	12.23	13.31	18.65	13.55	24.05	16.36	,,	,,
	Mean	12.40	17.31	20.06	13.63	25.66	17.81	1.40	1.83
Percentage female flowers setting fruit	1944	26.28	14.13	18.60	15.72	13.73	17.69	2.51	3.30
	1945	26.79	21.66	16.37	17.26	15.02	19.42	,,	,,
	Mean	26.54	17.89	17.49	16.49	14.37	18.56	1.77	2.33

Sig. diff. between seasonal means: No. of female flowers 0.88 (P=0.05), 1.16 (P=0.01).
Percentage females setting: 1.12 (P=0.05), 1.47 (P=0.01).

Apart from differences in the number of female flowers per cluster between clones, it will be seen that there was a greater number of flowers per cluster in all clones in 1944 than there was in 1945. The differences between seasonal means are significant P=0.01 for the average of all clones and also individually for clones 10, ZN24 and ZF9. On the other hand the mean percentage (over all clones) of female flowers setting fruit in 1945 is greater than that in 1944, the set being actually higher in 1945 for all clones except ZN24. Examination of the figures reveals that there is a significant negative correlation (−.4430 for all clones and both seasons) between the number of female flowers per cluster and the percentage setting fruit. In other words, as the average number of female flowers per cluster increases there is a tendency for the percentage of female flowers which set fruit to decrease.

11. Correlation with yield was studied by calculating the correlation coefficients between the values for the various characters observed in the 1944 and 1945 flowering seasons and the yields in 1945 and 1946 respectively. (The trees flower and set fruit in October-November of one year and the crop is harvested in May of the following year.) No consistent significant correlations were found. With some clones and in one season significant correlations do exist. For example, there is a significant positive correlation between yield and the number of seeds per cluster in 1944/45 with three clones (10, ZN24 and ZM8, r= + .5206, + 0.8000, and + 0.5153, respectively) but no significant correlation between these charac-

ters were found in the following season. It is evident that there are other factors which affect yield to a greater extent than the characters studied. Such factors are: size and vigour of tree, number of fruiting points or flower clusters, soil, season. The girth of the trunk 3 inches above the union of stock and scion is a good measurement of vigour or size of a tree and, as might be expected, there is a significant positive correlation between this figure and yield. Thus, in 1945 the following figures were obtained.

Clone	14	10	ZN24	ZM8	ZF9	All clones
Correlation coefficient ...	0.6610	0.6011	0.7955	0.3444	0.7727	0.3656

All the correlation coefficients are significant except that for ZM8. The figure for "all clones" is lower than those for the individual clones (except ZM8) because of the inclusion of two types of clone of different habit and because there is no significant correlation with clone ZM8. The other important factor influencing yield, i.e. the total number of fruiting points or flower clusters per tree, has not been studied owing to the very large amount of time which would be required for recording, and because it is obvious that a strong positive correlation must necessarily exist. The present investigation was mainly done in the hope that it might demonstrate a marked correlation between yield and some simple flowering or fruiting character. This would have been very useful for selection purposes, but unfortunately a correlation does not appear to exist.

Cultural and Manurial Experiments

12. The only experiment under this heading from which yield data over several years is available is a trial planted in December, 1940, which compared intercropping during the first four rainy seasons with (*a*) soya beans; plants removed when harvesting beans; (*b*) maize, trash buried after harvest; (*c*) green manure crop of velvet beans dug in annually; (*d*) cover crop of *Calapogonium mucunoides* intended to be permanent but which died out in the fourth season owing to failure to set seed. The main plots of this trial are divided to provide for a comparison of five clones, the yields of which are shown in Table 8 and have been mentioned in para. 8, above. The yields for the four cultural treatments for 1945 and 1946 are shown in Table 6. The yields from the plots intercropped with soya beans are still significantly better than those from the other treatments, between which there are no significant differences. Measurements of girth of the trunk at 3 inches above the point of union of stock and scion are shown in Table 7. The greatest growth has always been made by the trees in the soya plots, followed by the maize, velvet bean and *Calapogonium* treatments in that order, but since early 1944, when intercropping ceased, there has been a very gradual tendency for the differences to be reduced, and this season there is no significant difference between the soya and maize plots. It seems evident that clean cultivation with an intercrop which does not take much from the soil was very beneficial in giving the tung trees a good start and so far they have maintained this advantage.

TABLE 6

YIELDS, LBS. DRY HULLED SEED

Age, Years		Treatments				Sig. diff. per tree	
		Soya	Maize	Velvet	Calapog.	P=0.05	P=0.01
4	Per tree	10.1	7.2	6.3	4.8	1.45	1.95
	Per acre* ...	566	403	353	269		
5	Per tree	17.5	11.1	10.2	12.0	1.90	2.63
	Per acre* ...	980	622	571	672		

TABLE 7

GIRTH MEASUREMENTS, INCHES

Age, Years	Treatments				Sig. diff. per tree	
	Soya	Maize	Velvet	Calapog.	P=0.05	P=0.01
2½	10.7	9.2	8.6	8.4	0.62	0.85
3½	13.5	11.9	11.4	10.4	0.87	1.20
4½	16.7	15.3	14.0	13.4	1.12	1.55
5½	19.9	19.1	17.9	17.3	1.52	2.10

TABLE 8

YIELDS, LBS. OF DRY HULLED SEED

Age, Years	Clones										Sig. diff. per tree	
	ZN24		ZM8		14		ZF9		10		P= 0.05	P= 0.01
	Per tree	Per* acre	Per tree	Per* acre	Per tree	Per* acre	Per tree	Per* acre	Per tree	Per* acre		
All plots												
4	6.4	358	5.0	280	10.0	560	5.1	286	9.2	515	1.39	1.82
5	10.1	566	9.5	532	16.4	917	7.8	437	19.8	1,108	2.00	2.63
Soya plots only												
4	9.2	515	6.6	370	13.8	772	7.6	426	13.3	744	2.78	3.65
5	14.6	817	10.7	599	23.5	1,315	11.2	627	27.6	1,546	2.83	3.72

*Trees planted at 28 feet square = 56 per acre.

13. A second cultural experiment was begun this season with trees 2½ years old, in which it is intended to compare the following treatments :—(*a*) Trees circle weeded ; grass allowed to grow between rows, slashed twice and spread around the trees as a mulch. A small dressing of sulphate of ammonia is applied to the trees at the time of the first grass cutting. (*b*) Permanent leguminous cover crop of *Glycine javanica*. (*c*) Intercropping with soya beans. (*d*) Intercropping with a rotation of food crops. The first three treatments compare different intensities of cultivation without the removal of much plant food from the soil and increasing costs from (*a*) to (*c*), with the object of discovering the most economic degree of cultivation. Treatment (*d*) is equivalent to a common method practised on estates—that of allowing native tenants to grow food crops between the trees—which is certainly beneficial in the early years but may make too great a drain upon soil fertility.

14. Two manurial experiments were also begun this season. The first is a randomised block trial comparing tung press cake, cotton seed, farmyard manure, a complete artificial dressing and no manure. The field in which this trial is sited was under cultivation for many years before the opening of the station and is in poor heart. The trees have never done well on it and are not altogether suitable material for experimentation but since in any event manuring seemed necessary to improve the trees it was obviously desirable to do it on an experimental layout, even although the accuracy of the trial may be low. The second trial is a 25 factorial design with two complete replications (64 plots) but only three factors have yet been introduced. These are presence and absence of nitrogen, phosphate and potash, applied as sulphate of ammonia, superphosphate and muriate of potash. The other two treatments will be applied later in the light of further experience and one of them will probably be mulching.

Preliminary Root Studies

15. As a preliminary to more detailed and quantitative work, the root systems of three six-year-old seedling trees were excavated as completely as possible by digging and scraping in order to obtain a general picture of the nature and extent of the systems. Nothing very definite or detailed can be said on the subject of tung root systems until much more work has been done but it is perhaps worth noting that the three trees, all of which were on deep red loam, had the following features in common :—

(1) The " tap root " was either absent or only slightly developed.

(2) The main part of the system was a well developed plate of roots lying within 18 inches of the surface, and mostly in the top foot of soil.

(3) The spread of the roots was approximately twice the spread of the branches.

(4) Fine feeding roots were found over the whole area of the surface plate. Their distribution could not be studied in detail, but the impression gained was that there were few near the trunk, that the greatest concentration per unit area was in a ring 3 to 4 feet wide under the extremities of the branches, and that the amount of fine roots outside the spread of the branches was appreciably greater than that within.

Miscellaneous

16. A number of other investigations are in progress but are not at a stage at which there is anything of importance to report. These include the trial of " legitimate seedling families " derived from seed produced by selfing, or crossing between, high yielding trees ; the trial of clonal seedlings produced as a result of cross pollination in isolated gardens of buddings ; a fruit thinning trial with a very precocious clone, a spacing trial, and small scale work on vegetative propagation by cuttings.

TEA EXPERIMENTAL STATION, MLANJE

Officer in charge: *Mr. G. A. Bridger (under supervision of Mr. A. P. S. Forbes, Senior Agricultural Officer)*

Down pruning old Tea

17. This experiment was laid down on Ruo Estate in 1944 to investigate the present and other possible methods of treating down pruned old China Jat tea. The layout is a randomised block design with four treatments replicated six times. Fortnightly records of leaf yields were made. The complete sequence of tipping and pruning treatments is as follows :—

(1) Prune down to 14 inches and then tip to 27 inches ; cut across the following year to 22 inches and tip to 26 inches ; prune the next year to 20 inches tipping at 4 inches and prune up to 2 inches yearly tipping at 4 inches.

(2) Prune down to 14 inches and then tip at 27 inches ; prune up yearly 1 inch tipping at 27 inches until 18 inches pruning level is reached and then tip to 4 inches yearly.

(3) Prune 14 inches, tip 27 inches ; prune 24 inches tip 28 inches ; prune down yearly inch by inch until 20 inches is reached tipping 4 inches up each year ; thereupon prune up 1 inch yearly until 24 inches is reached, tipping 4 inches yearly.

(4) Prune 14 inches and tip 18 inches ; prune up 1 inch yearly and tip at 4 inches.

TABLE 9

Treatment No.	1	2	3	4
Yield per acre in lbs. made tea	608	633	502	660

18. The results from the second season (Table 9) showed that there was still no significant difference in yield between the treatments applied. The conclusion drawn from the first year was that the 18″ tipping did not reduce the yield as is the common contention and there was no apparent difference in the development of the wood. The conclusion from the results obtained from the second season confirm the findings in N. India where following a down prune to 14″, tipping is advocated at 4″ above the pruning mark and the tea is up pruned 1″ yearly, i.e. treatment (4) Again treatment 4 easily gave the highest yield and just missed being significant. This treatment is of special interest in this country as by using it the period between one down prune and the next is appreciably lengthened as the bush rises more slowly. In addition it would appear that less crop is lost by tipping low, which confirms the conclusion already reached in other investigations.

Tipping levels of China jat and influence of pruning methods on tipping

19. A previous experiment investigating the influence of the height of tipping on the yield of Indian jat indicated that yield was lost by tipping higher than 4 inches. A similar experiment which was laid down in a China jat garden on Ruo Estate in 1941, met with a misadventure and was restarted in 1944. The layout was a randomised block design with 6 treatments replicated 6 times. Fortnightly records of leaf yields were made. The treatments were as follows :—

(1) Cut across and tipped at 2 inches.

(2) Cut across and tipped at 4 inches.

(3) Cut across and tipped at 6 inches.

(4) Clean pruned and tipped at 2 inches.

(5) Clean pruned and tipped at 4 inches.

(6) Clean pruned and tipped at 6 inches.

The yields for this season are shown in Table 10. As in the 1944/45 season there are no significant differences.

TABLE 10

Treatment No.	1	2	3	4	5	6
Yield per acre in lbs. made tea	270	236	239	314	263	256

Treatment of young tea

20. This experiment was planted in March, 1942, to investigate different methods of bringing young tea into bearing. The layout was a 6×6 latin square and the initial treatments were as follows :—

(1) At twelve months to eighteen months after planting the young plants were centred (i.e. the

central main stems were removed to encourage the bush to spread). The bush was cut level at 14 inches, tipped to 27 inches and then plucked.

(2) From nine months onward the young plants were lightly plucked ; the bush was pruned at thirty months for the first time.

(3) The bush was cut across to 14 inches at eighteen months, tipped at 27 inches, and then up-pruned 2 inches yearly and tipped at 4 inches above pruning level.

(4) The bush was cut across to 8 inches at eighteen months, tipped at 27 inches, and then pruned to 14 inches at thirty months.

(5) The bush was cut across to 16 inches at eighteen months, left two years, and then up-pruned 2 inches yearly.

(6) The bush was allowed to grow for two and a half years and then pruned at 14 inches and up-pruned 2 inches yearly.

In 1943 treatment (2) gave a significantly higher yield than all other treatments. In 1944 treatments (1) and (5) gave significantly higher yields than treatment (6) ; treatments (2) and (5) being significantly higher than treatment (1). In 1945 there was no significant difference between treatments (1) to (5), but all were significantly higher in yield compared with treatment (6).

TABLE 11

Treatment No.	1	2	3	4	5	6
Yield per acre in lbs. made tea	525	559	553	514	528	502

The results from the past season, 1946, give no significant difference between any of the treatments (Table 11). Treatments (2) and (5) continued to give the best developed bushes and greatest spread. The following table gives the total yields for each treatment from 1942 to May, 1946.

TABLE 12

Treatment No.	1	2	3	4	5	6
Yield per acre in lbs. made tea	885	1,030	980	881	973	715

21. The conclusion which can be drawn from this experiment is that no matter what cultural method is applied to bring young tea in bearing the yield after a period of 4 years is the same. Treatments (2) and (5) encouraged the spread of the bush, which protects the soil, and gave an early return of leaf. Therefore these treatments can be said to be superior. The system of allowing the bush to run up for $2\frac{1}{2}$ years before pruning has nothing to recommend it. A further conclusion is that young tea responds to hard treatment, at least during the early stages of growth.

Spacing of tea

22. This experiment was planted in 1941 to investigate the optimum spacing of tea. The layout was a randomised block design with 4 treatments replicated 4 times, the treatments being as follows :—

(1) $3\frac{1}{2}$ feet by $3\frac{1}{2}$ feet.
(2) 4 feet by 4 feet.
(3) $4\frac{1}{2}$ feet by $4\frac{1}{2}$ feet.
(4) 5 feet by 5 feet.

The results from past years have indicated that the closer the spacing the higher the yields. In 1944/45 season treatments (1) and (2) continued to give a significantly higher yield than treatment (4). In the past season, 1945/46, treatment (1) gave a significantly higher yield than all other treatments and treatments (2) and (3) gave significantly greater yields than (4). (Table 13). The conclusion continues to hold good that the closer the spacing the higher is the potential yield of tea.

TABLE 13

Treatment No.	1	2	3	4	*Sig. Difference*	
					P=0.05	P=0.01
Yield per acre in lbs. made tea	1,006	876	866	721	102	147

Investigation of different methods of pruning and extending the pruning cycle

23. This experiment was devised to compare methods and frequency of pruning suitable for Indian

jat tea. In 1944, after 6 years of trials, it was concluded that the yearly pruning significantly reduced the yield of made tea, when compared with extended pruning cycle tea. The experiment has been continued. The layout is a 6 by 6 latin square and the treatments as follows :—

(1) Clean prune, every year.

(2) Cut across, every year.

(3) Cut across, with centre cleaned out, every year.

(4) Clean prune 1945 and unpruned 1946 (2 years cycle).

(5) Cut across 1945 and unpruned 1946 (2 years cycle).

(6) Clean pruned 1944, unpruned 1945 and 1946 (3 years cycle).

In January, 1945, it was noted that the cut across plots were not flushing as well as usual. For the first time since 1941 the three yearly pruned treatments (1) to (3) gave no significant difference in yield and treatments (4) and (5) were not significantly higher than the yearly treatments. The three year extended pruning cycle treatment (6) gave significantly higher yields than treatments (1), (2), (3) and (5), and for the first time, the clean pruned extended cycle tea (6) gave a significantly higher yield than the cut across extended cycle tea (5).

Results obtained for the present season were :—

TABLE 14

Treatment No.	1	2	3	4	5	6	Sig. Difference	
							P=0.05	P=0.01
Yield per acre in lbs. made tea	1,390	1,208	1,130	1,458	1,183	1,357	167	288

24. The object of this experiment was to investigate methods of controlling weeds and their effect of the yield of tea. The layout was a randomised block design with the following 6 treatments replicated 5 times.

(1) Hand weeding.

(2) Weeds slashed down.

(3) Weeds hoed and carried off.

(4) Weeds hoed and buried.

(5) Weeds hoed and left on surface.

(6) Left unweeded.

(7) Indigofera and Desmodium cover.

Results are given in Table 15. For the second year in succession there was no significant difference between treatments. The indication is strengthened that providing weeds are kept below the plucking surface, cultivation is not so essential for obtaining a maximum yield of tea, as is generally supposed.

TABLE 15

Treatment No.	1	2	3	4	5	6	7
Yield per acre in lbs. made tea ...	973	915	1,159	965	891	1,001	999

Vegetative propagation

25. Observations were continued on vegetative methods of propagation as described in the Ceylon Tea Quarterly Journal, Vol. 14, Part III. Single-node leaf cuttings proved best, while wood cuttings proved almost a complete failure. The effect of individual clone on the number of " takes " was marked and some of the selected bushes may have to be discarded because of their poor performance in the propagation beds.

NATIVE CROPS

PORT HERALD AND MAKANGA (CHIROMO) STATIONS

Agricultural Officer in charge, W. V. Rose

Flat versus Ridge Planting

26. It is often contended by Africans that on the light sandy soils of parts of the Lower River District crops planted on the tops of ridges would suffer from drought. A 5×5 Latin Square experiment

was therefore started at Port Herald in 1941, using a mixture of sorghum and bulrush millet, and over three seasons it showed no significant differences between the following treatments :—

1. Planting on the flat (African style).
2. Planting on the top of contour planting ridges.
3. Planting in the furrow between contour planting ridges.
4. Planting in the furrow and later splitting the ridges and reforming them along the line of plants.
5. Planting on the sides of the ridges.

In the 1944/45 season the design was changed to randomised blocks, with long, narrow plots, in the hope that a greater degree of soil variation would be eliminated in the blocks. Treatment (5) was omitted and the remaining four treatments were replicated 10 times. The indicator crop was again a mixture of sorghum and bulrush millet and again there were no significant differences between treatments. The mixed crop was not satisfactory and in 1945/46 a pure stand of sorghum was used, the yields obtained being shown in Table 16. Once again there were no significant differences.

TABLE 16

YIELDS OF UNTHRESHED SORGHUM HEADS

Treatment No.	1	2	3	4	Sig. difference P=0.05
Yield in lbs. per acre	1,284	1,432	1,259	1,110	395

Threshing out-turn approximately 54%.

Organic Manurial Experiment

27. The objects of this experiment, which is being conducted at Port Herald, are ; firstly, to determine the effect of compost on crop yield, and, secondly, to compare the burying of crop residues soon after harvest with the African practice of burning all crop residues just before preparatory cultivation of gardens begins. It is a randomised block trial with 8 replications of the following four treatments :

1. Compost at the rate of 30 tons per acre applied in October.
2. Stalks from the previous crop composted and applied one month before planting, i.e. early November. This gave an application of approximately 10½ tons per acre.
3. All plant refuse buried as soon after harvest as possible.
4. Plant refuse collected and burnt in October, immediately before garden preparation.

For the previous five seasons a similar trial has been running at Port Herald, but in the old trial green manuring was done as treatment (2) instead of the composting of crop residues and the indicator crop was mixed sorghum and bulrush millet instead of pure sorghum as in the current season's trial. Only once in the previous five years has any significant result been obtained and on that occasion the yield from plots receiving 30 tons of compost was superior to all others. The lack of general response to compost was possibly due to its being applied too early—August—and in the new trial the application is delayed until October. This year's yields are given in Table 17, from which it will be seen that the only significant result is that treatment (1) has given better yields than treatments (3) and (4).

TABLE 17

YIELDS OF UNTHRESHED SORGHUM HEADS

Treatment No.	1	2	3	4	Sig. diff. P=0.05	Sig. diff. P=0.01
Yields, lbs. per acre	2,411	2,027	1,630	1,540	525	715

Maize Harvesting and Mulching Experiment

28. This experiment was designed by Messrs. E. O. Pearson and B. L. Mitchell in connection with their work on the control of Red Bollworm on the Lower River. The first part of the experiment, which was carried out at Makanga Seed Farm and reported in the Annual Report for 1945, was to determine the effect on maize yields, and on the yields of interplanted cotton, of early harvesting of the maize. Subsequent to the harvesting of the maize and cotton the undermentioned treatments were applied in order to determine their effect on the following maize crop and also on the emergency of red-bollworm pupae buried in the plots. This second half of the experiment arose out of a theory that the mortality of bollworm pupae in the soil could be increased by cultural treatment e.g. digging, and also that high-soil temperatures prolonged the dormant period of bollworm pupae. If mulching could be shown to increase crop yields and also to reduce the resting period of bollworm pupae appreciably, its adoption might be worthwhile.

29. The experiment is of randomised block design and contains 6 replications of the following 5 treatments :—

1. *Dug.* The maize stalks from the previous crop were spread evenly over the field and the field dug at the end of July, the maize stalks being buried in the process.

2. *Bare fallow.* The plots were cleaned at the end of July, removing all stalks and weeds, and the plots left completely bare.

3. *Mulched.* Maize and cotton stalks from these plots and maize stalks from treatment (2) spread evenly over the plot.

4. *Unweeded.* Plots not weeded for a month before harvesting, and maize and cotton stalks left on the plot as mulch.

5. *African style.* Field cleaned at the end of October then left bare.

30. Yields as weight of unhusked maize were as follows :

TABLE 18

Treatment No.	1	2	3	4	5	Sig. diff.	
						P=0.05	P=0.01
Yield in lbs./acre	1,766	1,232	1,667	1,757	1,437	240	328

Treatment (1) is significantly better than treatments (2) and (5), (P=0.01). Treatments (3) and (4) are significantly better than treatment (2) (P=0.01) and (4) is better than (5) (P=0.05). From this single season's results there appears to be an indication that soil cover during the long dry season is beneficial.

Box Ridging Experiment

31. This experiment was begun in the 1945-46 season at Port Herald and its object is to determine the difference, if any, between half-boxed ridging, full-boxed ridging and no boxing of the ridges in their effect on (*a*) germination (*b*) crop yields (*c*) soil structure and erosion control. The efficiency of the three methods as regards erosion control was to be judged by the number of breaks occurring in the ridges after rain. The trial consists of 5 blocks each containing 3 plots to accommodate the three treatments :—

1. Half-boxed ridging.
2. Contour ridging (no boxing).
3. Full-boxed ridging.

The size of each plot is 32 yards×14 yards. The plots are surrounded by large ridges so that the water from any breaks in one plot cannot enter an adjoining plot but is lead away by down-drains running between the plots. The indicator plant is sorghum which is planted on the ridges in holes 3 feet apart, and 6 seeds are planted in each hole to give a fair measure of the germination in each plot. All ridges are 3 feet apart and 1 foot high, the tie ridges in treatment (3) being as high as the main ridges and in treatment (1), 6 inches high. The plots were examined after heavy showers of rain and the number of breaks in the ridges noted. The yield from each plot was measured as weight of unthreshed sorghum heads, because of the unavoidable losses which occur in threshing and winnowing by hand. Before planting, twenty samples of soil were taken from each plot, mixed and quartered in order to obtain a representative sample for the plot and these were to be used to compare the effect of the treatments on soil structure before planting. Other samples after harvesting were to give an indication of the absolute loss of structure during the season.

TABLE 19

YIELD, LBS. UNTHRESHED SORGHUM HEADS PER ACRE

Treatment No.	1	2	3	
Yield in lbs /acre	1,262	1,250	1,234	Not significant

GERMINATION

Treatment No.	1	2	3	
No. of seedlings per plot ...	662	552	543	Not significant

32. Yields and germination figures are shown in Table 19. There are no significant differences between treatments. The field was very badly attacked by variegated grass hoppers which destroyed

a large number of seedlings before they had been counted and the results of the germination count are therefore only valid if the attack was of equal severity all over the field. The land on which the trial was sited was of quite gentle slope and all treatments were equally efficient in stopping soil wash, no breaks occurring in any of the ridges. Owing to the transfer of the Agricultural Chemist no determination of the effect of treatments on soil structure has been made.

Cotton Variety Trial

33. An experiment to test five new strains of cotton against the Standard Crown Land Bulk was carried out at Chiromo, Port Herald and Mafumbe at the request of the Empire Cotton Growing Corporation. At Chiromo the cotton was interplanted with maize; at the other two stations it was in pure stand. The six varieties were replicated 8 times in randomised blocks, each plot consisting of two rows 3 feet apart and 54 yards long: Yields are shown in Table 20.

TABLE 20

YIELDS OF SEED COTTON IN LBS. PER ACRE

Sites	Variety						Sig. diff.
	Crown Land	C.L. 20–34	C.L. 20–46	B.181	B.P.52	T.22	P=0.05
Chiromo	36.4	17.3	17.3	12.3	25.2	20.1	14.2
Port Herald ...	322.0	253.7	276 6	250.3	236.9	227.9	43.8
Mafumbe ...	247	236	227	261	231	234	Not sig.

At all three sites the crop was very badly attacked by both red bollworm and stainers and yields were low, especially at Chiromo. The Crown Land Bulk gave significantly better yields at Port Herald and Chiromo but it is doubtful if any conclusions can really be drawn from these results.

Pigeon-Pea Rationing Experiment

34. Pigeon-pea, which is at present not very widely grown on the Lower River, is likely to play and increasingly important role. Not only does it provide a later crop of protein-rich food—which during the early months of the year is in short supply—but it is also likely to be a means of restoring fertility, together with grass-fallow, on the light sandy soils of the southern portion of the Shire Valley. Grass fallows are becoming scarcer as the pressure on the land increases, and in the absence of cattle, a "yielding" fallow is much more likely to appeal to the African cultivator than a pure grass fallow. Pigeon-pea on the Lower River is very susceptible to attack by termites, which kill the plants. This experiment (which was carried out at Makanga Seed Farm) is an attempt to determine the best method of treating pigeon-peas after the first crop has been taken in order to increase the vigour of the plant and reduce its susceptibility to termite attack and thus ensure a good stand of plants if the field is allowed to go fallow.

35. A crop of pigeon-peas was planted in February, 1945, with the intention of taking one crop and then permitting the field to lie fallow under pigeon-peas and grass. After harvest, the field was divided into plots, the number of plants per plot equalised, the treatments applied, and the field then allowed to tumble back to grass under the pigeon-peas. The layout consisted of 5 randomised blocks, each with 4 plots which were treated as follows:—

1. Main stem cut off 1 foot above ground level.
2. Main stem cut off 30 inches above ground level.
3. Main stem undisturbed but branches cut back to within 3 inches of the main stem.
4. Untreated control.

The results given in Table 21 were obtained after one year of fallow.

TABLE 21

YIELD OF PIGEON-PEAS (PODS)

Treatment No.	1	2	3	4	Significant Difference	
					P=0.05	P=0.01
Yield in lbs./acre ...	658	1.025	1,116	1,084	208	292

Shelling out-turn = approximately 40%.

There is no significant difference between treatments 2, 3, 4, but all three are better than treatment 1. Data for the number of plants surviving are given in Table 22.

TABLE 22

NUMBER OF PLANTS SURVIVING

Treatment No.	1	2	3	4	Sig. diff.	
					P=0.05	P=0.01
No. plants surviving in 5 plots	568	1.036	975	742	238	333

Treatment (2) is significantly better than treatments (1) and (4) (P=0.05), and treatment (3) is better than (1) (P=0.01). The difference between treatments 1 and 4 is not significant. In spite of the low survival of the plants in the untreated plots the yields are as good as those from the pollarded plants. This is explained by the fact that the lopped plants did not have the full benefit of the growing season in which to produce fruiting branches. It is suggested that plants should be treated as soon as possible after the first rains. The high mortality of plants in treatment 1 is explained as being due to damage by termites. In the plots under treatment (4) it is suggested that mortality due to scale insects and also mortality due to branches being broken while harvesting are partly responsible for the high percentage of deaths.

Miscellaneous

A number of other experiments which are being conducted in the Lower River District have not reached the stage at which results can be published. These include :—

(*a*) An organic manuring and mulching trial which compares the burying of all plant refuse as soon after harvesting as possible, the cutting of such refuse and spreading it as a mulch early in the dry season, the native method of burning all refuse towards the end of dry season, mulching with plant refuse plus elephant grass cut and carried from a plot of equal size, and mulching with pigeon-peas which have been grown between the previous maize crop.

(*b*) An experiment on the restoration of fertility by fallowing for various periods under elephant grass, pigeon-peas, pigeon peas and natural grasses, and natural grass cover.

(*c*) Trial of the effect of various rotations and fallow systems on the maintenance of fertility.

REPORTS FROM EXPERIMENTAL STATIONS

COTTON BREEDING

Variety Trials

Trials were carried out at the same places as in 1945, two in the Central Areas and three on the Lower River. In the first two trials at the Station and at Sharpevale, T.22 was out-yielded by the Crown Land bulk derivatives, and it seems probable that it and the C.L. 20 stocks are not in their present guise intrinsically heavier croppers than the Commercial Crown Land U.4 bulk. This variety is still capable of heavy yields when given good agricultural conditions with freedom from insect pests. Yield and ginning figures for the two Central Areas trials were as follows :—

Variety	Cotton Station		Sharpevale	
	lb. lint per acre	Roller G.O.T.	lb. lint per acre	Roller G.O T.
C.L. 20–30	263	36.7	—	—
C.L. 20–34	251	36.9	304	33.9
C.L. 20–46	269	37.7	298	34.7
C.L. Bulk (Chiromo)	—	—	302	33.6
B.181	237	35.4	244	33.2
T.22	234	34.0	223	31.8
B.P. 52	164	34.3	180	33.0
Sig. diff. (P=.05) ...	18	—	29	—

The failure of B.P.52, as a summer crop cotton, to produce yields comparable with local stocks is very evident in the above figures. This long stapled variety was also grown in a 5-acre bulk and yielded 162 lb. lint per acre.

Variety Trials on the Lower River were largely invalidated by excessive pest damage. Until the insect pest position is improved it is not likely that trials in this area will give results of any value.

Owing to lack of facilities no district variety trial can yet be arranged in North Nyasa, where the winter crop last year was a local record. The Department of Agriculture is opening a new experimental area and it is hoped to arrange trials there next year. An observation plot of B.P.52 was grown on flood land near Karonga with results which are reported to have been quite good, and a fairly large quasi-commercial trial of locally selected N.17 cotton was grown on a private estate. Neither yield per acre nor acreage are available, but the estate owner says he was very pleased with the performance of the cotton. Lint samples of both varieties have been spun by the B.C.I.R.A. with very satisfactory results.

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